these points, show an excess of 1.81 inches at Chattanooga, and 1.80 inches at Knoxville.

Summary.

Mean temperature, 49°.2; highest temperature, 79°, on the 1st, at Chapel Hill; lowest temperature, 12°, on the 27th, at Asheville; greatest daily range, 39°, on the 1st, at Knoxville, Tennessee; least daily range, 8°, on the 19th, at Smithville; mean daily range of temperature, 18°.9.

Average monthly rainfall, 3.85 inches.

Prevailing directions of wind, northeast and southwest.

Average number of clear days, 4; average number of fair days, 11; average number of cloudy days, 13.

Record of sunshine at Experiment Farm, two miles west of Raleigh, North Carolina.

Date.	Number of hours of possible sunshine.		Number of hours recorded by instrument		Degree of intensity.	Time of day during sunshine.	Remarks.
1887.	*h.*	*m.*	*h.*	*m.*			
Feb. 1	10	7	5	30	....	9.30 a. m. to 12.15 p. m., 1 p. m. to 3.45 p. m.	
2	10	9	0	0	....	....	Foggy all day.
3	10	10	3	0	Faint..........	1.15 p. m. to 2 p. m., 3 p. m. to 5 p. m.	
4	10	12	0	0	....	....	Cloudy.
5	10	15	0	0	....	....	Rainy.
6	10	17	0	0	....	....	Do.
7	10	20	4	45	Interrupted..	11.30 a. m. to 4.15 p. m....	
8	10	22	4	0	Bright	12.30 p. m. to 4 40 p. m.....	
9	10	25	2	45	Faint	9.30 a. m. to 12.30 p. m...	
10	10	27	1	0	Faint haze...	1.15 p. m. to 2.15 p. m....	
11	10	29	6	30	Faint	9.45 a. m. to 4.15 p. m.....	
12	10	31	6	0	......do......	9.45 a. m. to 3.45 p. m.....	
13	10	34	7	0	Bright	9.15 a. m. to 4.15 p. m.....	
14	10	36	0	0	....	....	Cloudy.
15	10	39	0	0	....	....	Do.
16	10	42	6	15	Bright	11 a. m. to 5.15 p. m........	
17	10	44	7	0	......do	9 a. m. to 4 p. m............	
18	10	46	1	30	Faint	Various intervals	
19	10	49	6	30	Bright	9.30 a. m. to 4 p. m.........	
20	10	52	0	0	....	....	Cloudy.
21	10	55	0	0	....	....	Do.
22	10	57	0	0	....	....	Do.
23	11	00	0	0	....	....	Do.
24	11	3	5	15	Faint	12.30 p. m. to 5.30 p. m.....	
25	11	6	5	15	Bright	9.15 a. m. to 2.30 p. m.....	
26	11	8	0	0	....	....	Cloudy.
27	11	10	7	45	Bright	9 a. m. to 4.45 p. m........	
28	11	12	8	0	......do..........	9 a. m. to 5 p. m...........	
Average..	10	39	3	9			

The following is an extract from the "Tennessee State Board of Health Bulletin" for February, 1887, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, Director of the State Meteorological Service:

The month of February was characterized by an abnormally high temperature with an excessive amount of rainfall and high winds, also for the absence of snowfall.

The mean temperature was 49°.3, more than four degrees above the highest February mean of the past four years, and as much as 15°.5 above the 1885 mean, which was the lowest of the period named. The highest temperature, 76°, recorded on the 2d and 10th, was the greatest maximum in February of the past four years, being 2° above that in 1884—the next highest. The lowest temperature, 25°, recorded on the 18th and 28th, was the highest minimum recorded in February of the past four years, the next highest being 4° below zero in 1885. It was 42° above the February minimum in 1886—a remarkable difference. The general ranges of temperature were small compared with those of the two preceding years. During the month, four cold waves extended over the state, three of which were verifications of the predictions, and one a partial verification. The first was announced on the 3d, temperature 35°, minimum reached 26°.3 on the 4th. This warning was partially verified. The second was announced on the 8th, temperature 67°, minimum 42° on the 9th. The third was announced on the 11th, temperature 57°, minimum 22°.7 on the night of the 12th and morning of the 13th. The fourth was announced on the 26th, temperature 60°, minimum 28° on night of the 27th and morning of the 28th. The last three were fully verified.

The mean depth of rainfall was 8.03 inches, more than two inches greater than the February mean of the past four years, and not quite half an inch less than the mean of February, 1884, which was abnormally great. It was 5.64 inches greater than the mean in 1885, and 4.23 inches greater than that in 1886. Of this amount the eastern division received an average of a little more than seven inches, the middle division about eight and three-fourths inches, and the western division nearly seven and a half inches. The greatest monthly rainfall was 13.08 inches, reported at Riddleton, which also reported the greatest February rainfall in 1884 and 1885. The least rainfall was 5.35 inches, reported at McKenzie. The greatest local daily rainfall was 4.38 inches, reported at Dickson on the 23d. The days of greatest rainfall were the 3d, 14th, 23d, and 26th; the greatest fall being on the 23d, when an average of about an inch an a half of rain fell throughout the state. The rain of the 14th was very nearly as great. The 10th, 27th, and 28th were the only days reported without rain. Most of the rains during the month were general, though many of them were light. The proportion of cloudiness was abnormally great. A marked feature was the entire absence of snowfall. The winds during the latter half of the month were high, and destructive to timber and fencing. Several severe electric storms accompanied the rains. Frosts occurred on about ten days, and about half of them were killing frosts.

Summary.

Mean temperature, 49°.3; highest temperature, 76°, on the 2d, at Hohenwald, and on the 20th, at Riddleton; lowest temperature, 20°, on the 13th at Hohenwald, and on the 28th, at Greeneville, Cookeville, and Manchester; range of temperature, 56°; mean monthly range of temperature, 47°.7; greatest monthly range of temperature, 56°, at Hohenwald; least monthly range of temperature, 41°, at Rogersville; mean daily range of temperature, 14°.2; greatest daily range of temperature, 41°, on the 3d, at Milan and Memphis; least daily range of temperature, 2°, on the 6th, at Waynesborough; mean of maximum temperatures, 72°.3; mean of minimum temperatures, 23°.9.

Average number of clear days, 4.7; average number of fair days, 7.1; average number of cloudy days, 16.2; average number of days on which rain or snow fell, 12.5.

Warmest days, 2d, 10th; coldest days, 13th, 28th.

Prevailing winds, south and southwest.

NOTES AND EXTRACTS.

BAROMETRIC PRESSURE DURING HIGH WINDS.

The following report by Sergeant D. J. Carr, observer at Mount Washington, New Hampshire, has been received by the Chief Signal Officer in reply to a communication directing that special observations of the mercurial and aneroid barometers be made at that station for the purpose of ascertaining, approximately, the effects of high winds and gusts on barometric pressure within a room like that of the station at Mount Washington:

I have the honor to report that the observations have been made as directed and the utmost care taken to secure reliable data. The construction of this building rendered it impossible to obtain direct exposures of the barometers to the windward, and the leeward window used to obtain data is southeast, twenty-four feet distant, and in a different room from where the barometers are situated, as may be seen by consulting the attached diagram. From the data obtained, I would make the following reply to the questions contained in your letter:

1st. "When very violent winds are blowing, does the mercurial barometer fluctuate or pump noticeably; if so, what is the range and what is the duration of the fluctuations, and how are they related to gusts of wind?" Answer: Rapid fluctuations of the barometer are always noticed during the prevalence of high winds, but the extent of these fluctuations are dependent upon the ingress or egress furnished the air, if all windows and doors are closed the fluctuations do not exceed .003 of an inch, but they are practically continuous and are due to the air escaping through the open door of the stove; to obviate this is impracticable, as it is necessary to keep the drafts closed; it is also believed, too, that the swaying or trembling of the building has a slight effect upon the column of mercury in the barometer. The fluctuations of pressure during high winds when either a windward or leeward window is open are very marked, and will be referred to.

2d and 3d. "Do these fluctuations consist principally in a dropping below an average or in a rise above; which occurs first, the drop or the rise? What is the difference in character and extent of these fluctuations under the following different conditions: Doors and windows all shut and the chimney draft and stove closed as much as possible; doors and windows shut and the chimney draft opened wide; chimney closed and a leeward window open; chimney closed and a windward window open?" Answer: the curve of fluctuation depends upon whether the air is admitted to the room by opening a windward window, or an escape to the leeward furnished it. If a windward opening is made an increased pressure is immediately noted, the increase being proportional to the velocity of the wind; if a leeward window is opened a decreased pressure is shown. There is, however, a difference both in the character and extent of the fluctuations under the above conditions. The opening of a windward window and the increase of pressure are synchronous, while if a leeward window is opened an interval of time elapses before a decreased pressure is noted; this interval is very small, probably not more than a second, and is caused, perhaps, by the immediate surcharging with air of the room when a windward opening is made, while when a leeward window is opened the air lacks, as it were, the force to push it out at once. With doors and windows closed and the chimney drafts open there are slight fluctuations, a wind of 100 miles per hour causing a rise or fall in the barometer of not more than .006 of an inch, the fall generally occurring first, although the opposite has been occasionally noticed.

4th. "Besides the changes in fluctuations, possibly due to the opening of windows, is there any difference in the general height of the barometer due to open and closed windows and chimney?" Answer: Yes; the general height of the barometer during high winds, excluding fluctuations, is sensibly affected by the opening of a windward or leeward window; in the former case it is above and in the latter below the normal, the effect being greater under the former conditions, and in both cases the extent is governed by the velocity of the wind, being, in fact, proportional to its velocity.

In making the observations, the aneroid barometer was placed on a tripod, two feet distant from, and the same elevation given it as, the cistern of the mercurial barometer. It is intended to investigate further next summer the effects of wind gusts upon barometric pressure at this station by other and somewhat different observations, and it is believed interesting data will be secured.

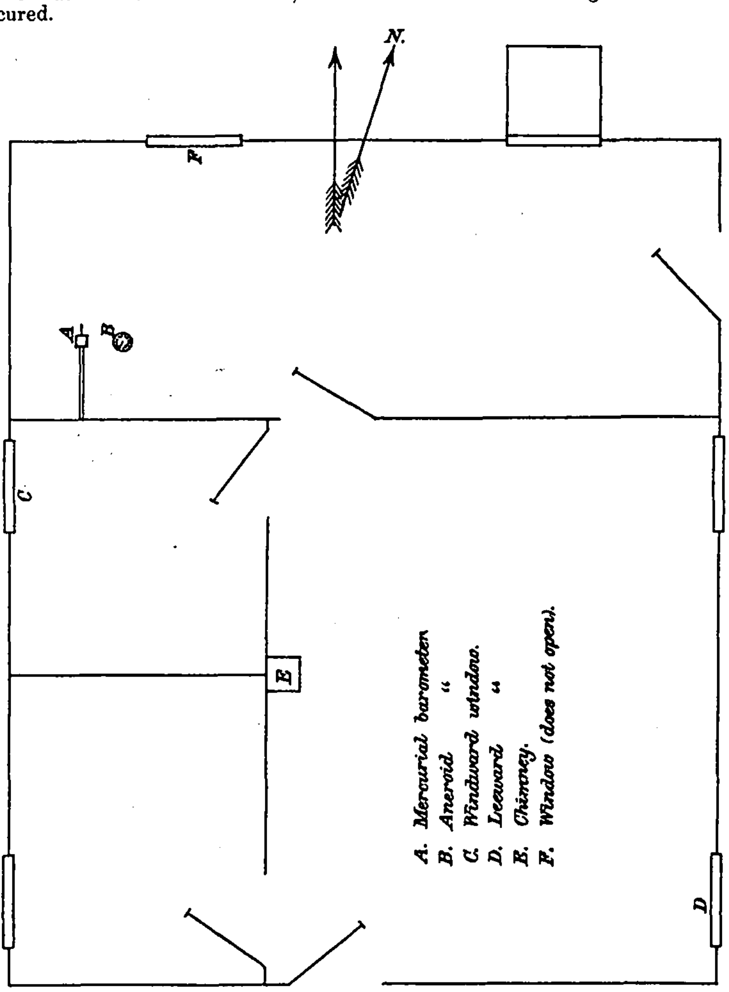

Diagram showing location of instruments at the Signal Service station, Mount Washington, N. H.

KRAKATOA SMOKE AND THE SKY-GLOWS.

[By Junior Prof. H. A. Hazen.]

Professor Kiessling, of Hamburg, has recently published an important paper on this subject (*see* Sitzungsber der Kgl. Preuss. Akad. d. Wiss. zu Berlin, p. 529, 1886). Perhaps the most significant part of the paper is a partial denial of the commonly-held view that the remarkable sky-glows, beginning in the latter part of August, 1888, were due to the effect of fine volcanic ashes thrown into the upper atmospheric layers by the very violent outburst of Krakatoa on August 27, 1883. Professor Keissling writes: "It is easy to show that air which is full of extremely fine dust, or artificially ground Krakatoa dust, has very little influence in the development of homogeneous clouds, or clouds consisting of uniform water-drops, in comparison with the powerful cloud-forming action which comes from such gases of combustion as are beyond direct optical observation."

Granting that it is possible to infer from the results of a laboratory experiment what may be the probable action of similar forces in nature's vastly greater laboratory, it is gratifying to see that Professor Kiessling has abandoned the theory of the sufficiency of Krakatoa ashes to produce the sky-glows, which is beset with insurmountable difficulties. It would seem, however, that in attributing the same effect to the smoke of the volcano, he has introduced difficulties far more serious than any to be met in the original view. The following are a few of the more serious objections to the theory that the sky-glows were caused by Krakatoa smoke or gases.

1st. If any one will project the various first appearances of the glows upon a map he will find that, even after making due allowance for lack of records, for non-uniformity in the scale of intensity, etc., it is still impossible to connect them by any reasonable hypothesis with smoke clouds coming from Krakatoa.

2d. The facts require that there be two currents in the upper atmosphere, starting from Krakatoa, and running in opposite directions at a velocity about forty metres per second (eighty-nine miles per hour). This is clearly impossible.

3d. There is unquestioned evidence that the movement of the upper atmosphere is from west to east, which is contrary to the movement of the bulk of the supposed Krakatoa smoke current.

4th. No velocity even approximating to forty metres per second, can be admitted. The highest average August velocity on Pike's Peak, which is more than 2,500 miles north of the equator, and 14,134 feet above sea-level, is ten metres per second, and on the highest mountains near the equator, where we have observations, it is somewhat less than that. The motion of the highest cirrus clouds is from the west, and, while in the neighborhood of storms, there have been estimated velocities of forty metres, per second, for a short time, yet it is highly probable that the average velocity in the summer season is not over ten metres, per second. Professor Kiessling cites Prof. W. Siemens as authority for the theory that the earth rotates on its axis without carrying the upper air strata with it. It may be safely said that this theory is utterly untenable.

5th. That the sky-glows were largely dependent on meteorological conditions was very apparent in the higher latitudes. They were only seen in perfection in the evening, when there was a marked area of high pressure to the west. It was frequently remarked that on some clear nights, when the conditions appeared favorable for the manifestation, provided it was dependent upon a cloud of smoke, there were no glows to be seen.

6th. It is highly probable that no possible velocity of propulsion could carry smoke or gas to anything like the height needed for explaining the phenomena, but granting that this smoke reached the higher regions of the atmosphere, say twenty kilometres (nearly thirteen miles), it will be admitted, I think, that it would be diffused throughout the whole upper regions with a velocity approaching that of sound, and in a few seconds the resulting density would be altogether too slight to produce any marked effect on the sun's light. This last consideration shows how utterly wide of the mark is the theory that there could be anything approaching even a *cloud* of this smoke.

There are many other objections to the theory that these glows could have been produced by any direct ejecta from Krakatoa, but the above views are sufficient to show its great weakness. There seems to be a gradual settling down of meteorologists to the view that the glows were an extraordinary intensification of ordinary sunrise and sunset phenomena, which we know are due to the presence of water or ice particles in the atmosphere. It is probable that an unusual electrical activity, possibly concomitant with the Kraktoa outburst, was in part needed, and, in addition, it was necessary that the meteorological conditions be favorable. A combination of all these elements would produce the glow in all its intensity, and an absence or diminution of any one or more would give a less effect.

The following table, furnished by Capt. M. W. Wood, Assistant Surgeon, U. S. Army, and forwarded by 2d Lieut. D. L. Brainard, 2d Cavalry, U. S. Army, is a recapitulation, by months, of meteorological data observed at Fort McPherson, Nebraska, from 1870 to 1878, inclusive. The force of wind is estimated on a scale of 1 to 10, counting 1 for a light breeze and 10 for a gale of fifty miles per hour:

From 1870 to 1878.	Temperature.								Precipitation.							
	Highest maximum.	Lowest minimum.	Highest monthly range.	Lowest monthly range.	Average monthly range.	Highest monthly mean.	Lowest monthly mean.	Average monthly mean.	Mean No. of days on which rain or hail fell.	Mean No of days on which snow fell.	Total No. of days on which rain, hail, or snow fell.	Highest precipitation.	Lowest precipitation.	Average precipitation.	Total for eight years.	Average force of wind.
	°	°	°	°	°	°	°	°				In.	In.	In.	In.	
January	78	—30	84	64	74.2	33.2	7.7	23.8	0.5	4.1	37	1.28	0.02	0.31	2.48	2.6
February	78	—24	86	53	70.4	38.7	18.6	31.4	1.1	3.5	37	0.45	0.08	0.23	1.85	2.4
March	83	— 4	84	67	75.4	46.7	33.4	38.1	1.6	3.9	45	2.25	0.07	0.92	7.38	2.9
April	96	5	97	65	75.2	53.8	44.2	46.7	4.6	2.4	56	4.72	0.34	2.30	18.46	3.1
May	96	25	65	55	61.2	65.5	56.7	58.8	10.1	....	81	8.41	1.82	3.84	30.71	2.8
June	104	33	66	52	59.4	78.9	67.7	72.6	7.9	....	63	8.56	0.64	3.08	24.68	2.7
July	115	35	80	49	59.2	83.3	74.4	77.6	9.1	....	73	4.22	0.74	2.63	21.04	2.5
August	110	36	74	51	59.8	80.8	71.1	75.2	7.4	....	59	3.12	0.48	1.76	14.13	2.4
September	102	19	79	60	69.1	66.7	62.2	64.5	6.9	....	55	5.48	1.06	2.14	17.17	2.5
October	100	6	91	60	73.9	55.7	47.1	52.4	2.0	1.1	25	1.96	0.01	0.54	4.35	2.3
November	80	—12	84	64	74.6	46.2	32.0	35.8	1.4	2.0	27	2.84	0.00	0.52	4.18	2.5
December	74	—20	90	58	72.2	35.9	19.2	26.7	0.9	3.6	36	3.20	0.10	0.64	5.16	2.1
For eight years	115	—30	97	49	68.7	83.3	7.7	50.3	....	....	594	8.56	0.00	1.58	151.59	2.6